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Cancer

Cancer, including neoplasms of the lymphatic and hematopoietic (blood-cell-forming) systems, is the cause of 22 percent of all deaths in the United States. Each year about 600,000 people develop cancer, and most of them, more than 420,000, die of the disease. The amount of suffering associated with cancer is much greater than that for most other diseases. It is for this reason that the federal government has emphasized research on cancer and has allocated several hundred million dollars per year for cancer research, reaching $1 billion this year.

Despite the great amount of money and effort expended in the study of cancer, progress during the last twenty-five years has been slow. A significant increase in survival time after diagnosis was achieved about thirty years ago, largely through improvements in the techniques of surgery and anesthesia. During the last twenty-five years some improvement in treatment of certain kinds of cancer has been achieved, mainly through the use of high-energy radiation and chemotherapy, but for most kinds of cancer there has been essentially no decrease in either incidence or length of time of survival after diagnosis, and it has become evident that some new ideas are needed, if greater control over this scourge is to be achieved.

One new idea is that large doses of vitamin C may be used both to prevent cancer and to treat it. The most important work along this line has been carried out by Dr. Ewan Cameron, formerly chief surgeon in Vale of

Leven Hospital, Loch Lomondside, Scotland, and now medical director of the Linus Pauling Institute of Science and Medicine. I have had the good fortune of having been associated with Dr. Cameron in his clinical research in this area during the last fourteen years. Accounts of our work are given in the book *Cancer and Vitamin C* (1979) and the published papers cited in the references section and are summarized later in this chapter. Another surgeon who has made important contributions in this field is Dr. Fukumi Morishige, of Fukuoka, Japan.

Irwin Stone in his 1972 book *The Healing Factor: Vitamin C Against Disease* discussed the early reports that doses of vitamin C of 1 to 4 grams (g) per day, sometimes given together with an increased intake of vitamin A, seemed to have value in controlling cancer in some patients. This work was done largely by German physicians in the period between 1940 and 1956. Despite the indication that these doses of vitamin C were of value in the treatment of cancer, the early studies did not lead to a thorough examination of the possible virtues of vitamin C in that connection. Some favorable results were also reported in studies with animals, but the early work in this field too was not followed up.

In 1951 it was reported that patients with cancer have usually a very small concentration of vitamin C in the blood plasma and in the leucocytes of the blood, often only about half the value for other people. This observation has been verified many times during the last thirty years. In 1979 Cameron, Pauling, and Brian Leibovitz listed thirteen studies, all showing large decreases in both plasma and leucocyte concentrations. The level of ascorbic acid in the leucocytes of cancer patients is usually so low that the leucocytes are not able to carry out their important function of phagocytosis, of engulfing and digesting bacteria and other foreign cells, including malignant cells, in the body. A reasonable explanation of the low level of vitamin C in the blood of cancer patients is

that their bodies are using up the vitamin in an effort to control the disease. The low level suggests that they should be given a large amount of the vitamin in order to keep their bodily defenses as effective as possible.

Only one of the early reports on vitamin C and cancer dealt with the use of large doses of vitamin C over as long a period as eighteen months. In 1954 Dr. Edward Greer, of Robinson, Illinois, published a report about a remarkable patient who apparently controlled his cancer (chronic myeloid leukemia) over a period of two years by the oral intake of very large amounts of vitamin C. This patient, an elderly executive of an oil company, had a number of concurrent illnesses. He developed chronic heart disease in September 1951 and was described in May 1952 as having alcoholic cirrhosis of the liver and polycythemia (an increased number of circulating red blood cells). In August 1952 the diagnosis of chronic myeloid leukemia was established and verified by an independent hematologist. In September 1952, after extraction of some of his teeth, he was advised to take some vitamin C to promote healing of his gums. He immediately began to take very large amounts, from 24.5 g to 42 g per day (seven 500-milligram [mg] tablets taken seven to twelve times a day). He said that he set this regime for himself because he felt so much better when he took these very large doses. The patient repeatedly remarked about his feeling of well-being, and he continued in active employment. On two occasions Greer insisted that the vitamin C be stopped. Both times when the patient did so his spleen and liver became enlarged, soft, and tender, his temperature rose to 101 degrees, and he complained of general malaise and fatigue, typical leukemic symptoms. His signs and symptoms rapidly improved when he resumed the intake of vitamin C. He died of acute cardiac decompensation in March 1954, at age seventy-three. His spleen was then firm, and the leukemia, polycythemia, cirrhosis, and myocarditis had

shown no progression during the eighteen months since he began his intake of large doses of vitamin C. Greer concluded that "the intake of the huge dose of ascorbic acid appeared to be essential for the welfare of the patient."

In 1968 Cheraskin and his associates described a synergistic effect of supplemental ascorbate on the radiation response in patients with squamous-cell carcinomas of the uterine cervix. Twenty-seven patients were given 750 mg of ascorbic acid per day, beginning one week before the radiation treatment and continuing until three weeks after its termination; in addition they received a vitamin-mineral supplement and general nutritional advice (decrease in intake of sucrose). The controls were twenty-seven similar patients who did not receive the vitamins or nutritional advice. Radiation therapy was equally vigorous for the two groups. The response to the radiation was significantly higher for the nutritionally treated patients (average score 97.5) than for the controls (average score 63.3). Thus there is some evidence that cancer patients undergoing radiotherapy have an increased requirement for ascorbic acid and that satisfying this increased requirement protects against some of the harmful effects of irradiation as well as potentiating the therapeutic response.

The late Dr. William McCormick of Toronto appears to have been the first to recognize that the generalized connective-tissue changes that attend scurvy are identical with the local connective-tissue changes observed in the the immediate vicinity of invading neoplastic cells (McCormick, 1959). He surmised that the nutrient (vitamin C) known to be capable of preventing such generalized changes in scurvy might have similar effects in cancer. The evidence that cancer patients are almost invariably depleted of ascorbate lent support to his view.

There are some other interesting associations between scurvy and cancer. The historical literature contains many

allusions to the increased frequency of "cancers and tumors" in scurvy victims. A typical autopsy report of James Lind (Lind, 1753) contains phrases such as "all parts were so mixed up and blended together to form one mass or lump that individual organs could not be identified," surely an eighteenth-century morbid anatomist's graphic description of neoplastic infiltration. Conversely, in advanced human cancer, the premortal features of anemia, cachexia, extreme lassitude, hemorrhages, ulceration, susceptibility to infections, and abnormally low tissue, plasma, and leucocyte ascorbate levels, with terminal adrenal failure, are virtually identical with the premortal features of advanced human scurvy.

Epidemiological evidence indicates that cancer incidence in large population groups is inversely related to average daily ascorbate intake. Of the several different published investigations, all giving essentially the same result, I mention the work of the Norwegian investigator Bjelke who in 1973 and 1974 published accounts of the exhaustive studies that he had made of gastrointestinal cancers by means of a dietary survey by mail and a case-controlled study. His work, which involved more than thirty thousand people in the United States and Norway, included a determination of the consumption of various foods, as well as smoking habits and other factors. He found a negative correlation between the consumption of fruits, berries, vegetables, and vitamin C and the incidence of gastric cancer, whereas starchy foods, coffee, and salted fish were positively correlated. The two most important factors were, he concluded, the total intake of vegetables and the intake of vitamin C. The greater the intake of vegetables and of vitamin C, the smaller is the incidence of cancer.

In 1973 I went to the National Cancer Institute to show a dozen top specialists there the case histories of the first forty patients with advanced cancer in Vale of Leven Hospital, Loch Lomondside, Scotland, who had been

treated with 10 g of vitamin C per day by Dr. Ewan Cameron; my objective was to ask these specialists to carry out a controlled trial of vitamin C. They were not impressed by the evidence or the possibility that some control over cancer could be achieved by using large doses of this vitamin as an adjunct to appropriate conventional therapy. My wife, who had accompanied me, said afterwards that she had never before seen a group of medical researchers with less interest in new ideas. They told me that the National Cancer Institute would not do anything with vitamin C until studies had been made with animals.

Those specialists did suggest, however, that I apply to the National Cancer Institute for a grant to provide support for our Institute in California to carry out such a study. I at once applied to the institute for a grant to support studies of vitamin C in relation to cancer in mice and guinea pigs. It was approved as scientifically sound by the institute's consultants, but it was turned down. My next seven applications met the same fate. Finally the National Cancer Institute made a grant to us that provided partial support for a careful study of vitamin C in relation to spontaneous breast cancer in mice that we conducted in our institute in Palo Alto from 1981 to 1984. This study is by far the most carefully carried out and reliable animal study of vitamin C and cancer that has ever been made (Pauling et al., 1985).

The mice used in this investigation, strain RIII, begin to develop palpable breast tumors at about age forty weeks. Formation of the tumors involves a virus that is transmitted from mother to daughter in the maternal milk. The rate at which the first tumor develops after the end of the lag period is constant—that is, after that age the tumorless mice have the same chance each week of demonstrating the first tumor.

In our study we had seven groups of mice, fifty in each group, eating carefully prepared food containing

percentages of 0.076, 1.86, 2.9, 4.2, 8.0, 8.1, or 8.3 of added ascorbic acid. They began these diets at age 9 weeks and continued it to age 114 weeks. Mice burdened with tumors were killed to prevent suffering. We found that the lag period increased steadily with increasing intake of vitamin C, from age 38 weeks for 0.076 percent C to age 52 weeks for 8.3 percent C. Also, the rate of appearance of the first tumor among each group of mice decreased steadily in percentage, from 2.7 per week for 0.075 percent C to 0.7 per week for 8.3 percent C. The biostatistical evaluation of the results shows that the confidence level of the conclusion that increased amounts of vitamin C in their food leads to decreased incidence of spontaneous breast cancer in this strain of mice is extremely high. The chance that the observations are the results of a statistical fluctuation is only about one in a million.

The overall result is that the age at which the tumor appears increases greatly with increased intake of vitamin C. This age for half the mice to develop a tumor (the median age) increases from 66 weeks for the smallest amount of the vitamin to 120 weeks for the largest amount. Development of the cancer is delayed in the RIII mouse strain from middle age to extreme old age.

Similar results with skin cancer in mice caused by irradiation with long-wavelength ultraviolet light (similar to sunlight) were obtained in an earlier study in our institute (supported by contributions by many people, not by the National Cancer Institute) (Pauling, Willoughby, et al., 1982). Other animal studies made by various investigators, usually with much smaller groups, have given less reliable results.

It has been recognized for many years that patients with cancer have a decreased level of vitamin C in the blood and also that these patients, especially children with cancer, have a high tendency to develop infections. Infection is a major cause of morbidity and of mortality

in children with cancer, partially because the anticancer therapy damages the immune mechanism.

The low level of vitamin C in the blood should, of course, be rectified for all cancer patients by a high intake of the vitamin. This high intake should function to provide some protection against infectious diseases and should be a valuable adjunct to conventional therapy in the treatment of the infectious diseases as well as of the cancer itself. These facts about vitamin C, infection, and cancer seem never to have been learned or to have been forgotten by many physicians. An example is a recent article on infections in children with cancer (Hughes, W. T., 1984, "Infections in children with cancer: Part I: Most common causes and how to treat them," in *Primary Care & Cancer*, October, pp. 66–72). This article mentions eleven factors as indicators of increased susceptibility of infectious disease in a child with malignancy. One of these factors is malnutrition. There is some discussion of the effect of the anticancer therapy and the type and extent of the malignancy on the natural defense mechanisms of the body, but there is no discussion of vitamin C and other nutrients in strengthening the defense mechanisms and essentially no discussion or recommendations about nutrition. There is no mention in the article of the fact that cancer patients have a decreased level of ascorbate in the blood, which should be rectified.

Ascorbate in the human body has rather wide powers to destroy toxic substances. It collaborates with enzymes in the liver to react with these substances, often by hydroxylating them, converting them into other substances that are not toxic, for elimination then in the urine. We do not yet have information about the extent to which the optimum intake of vitamin C can provide protection against the carcinogenic substances in our foods, drinks, and environment that get into our bodies, but some examples show that this effect may be large.

Nitrites and nitrates in foods such as bacon and other preserved meats react in the stomach with amino compounds in the stomach contents to form nitrosamines, which are carcinogenic and which cause cancer of the stomach. A good intake of vitamin C destroys the nitrites and nitrates and prevents stomach cancer. A vigorous effort is being made now to reduce the amounts of nitrites and nitrates in foods, as a way of controlling cancer. Increased intake of vitamin C can also help to achieve this end.

It has also been reported that the cancers that often appear in the bladders of cigar smokers and other users of tobacco regress if the patient ingests a sufficient amount of ascorbic acid, 1 g per day or more. Schlegel, Pipkin, Nishimura, and Schultz (1987) found the ascorbic-acid level of the urine to be about half as great for smokers as for nonsmokers and to be low for patients with bladder tumors. They also found with mice that implantation in the bladder of a pellet containing 3-hydroxyanthranilic acid (a derivative of the amino acid tryptophan) caused bladder tumors to develop if the mice were receiving a normal diet but not if they had extra ascorbic acid in their drinking water. The authors suggest that the ascorbic acid prevents the oxidation of 3-hydroxyanthranilic acid to a carcinogenic oxidation product. They state, "There seems to be reason to consider the beneficial effects of an adequate ascorbic acid level in the urine (corresponding to a rate of intake of 1.5 g per day) as a possible preventive measure in regard to bladder tumor formation and recurrence." They also call attention to investigations indicating that ascorbic acid may have a beneficial effect on the aging process of atherosclerosis, the hardening and thickening of the walls of the arteries (Willis and Fishman, 1955; Sokoloff and others, 1966).

It was reported by Dr. Robert Bruce, director of the Toronto branch of the Ludwig Cancer Research Institute.

in 1977 that there are mutagenic and presumably carcinogenic substances in the intestinal contents of human beings. Later he and his associates reported that a good intake of vitamin C greatly reduces the amount of these substances (Bruce, 1979). In this way, and also by reducing the residence time of the waste material in the body, as we discussed in Chapter 10, a proper intake of vitamin C helps to protect the lower bowel against cancer.

Colonic polyposis is a genetic disease characterized by the formation of large numbers of polyps in the colon and rectum. These polyps are benign tumors, but their presence has long been recognized as a premalignant condition. According to Willis (1973), "Victims of familial polyposis are almost certain to die of carcinoma of the colon or rectum at an early age." There is, however, now hope for them. Studies by DeCosse et al. (1975), Lai et al. (1977), and Watne et al. (1977) with sixteen persons with familial polyposis gave the result that the regular intake of 3 grams of vitamin C per day caused the polyps to disappear in half of the patients. There is a real possibility that a larger intake, of 10 or 20 g per day, would control the disease in others.

Before we met each other and began our collaboration, Ewan Cameron had carried out operations on hundreds of patients with cancer in his surgery in Scotland. Like many other people, he thought that this disease, which causes so much suffering, needed a fresh approach. He gathered a large amount of information about cancer and formulated a new theory on its causation, which he published in a book, *Hyaluronidase and Cancer*, in 1966. In this book he suggested that a significant amount of control over cancer might be achieved by strengthening the natural defense mechanisms of the human body. In particular, he mentioned that malignant tumors are known to produce an enzyme, hyaluronidase, that attacks the intercellular cement of surrounding tissues, weakening

this cement to such an extent as to permit invasion of the tissues by the neoplasm. He suggested that some way might be found to strengthen the intercellular cement and in this way to build up the natural defense mechanisms of the body to such an extent as to resist attack by the malignant cells. For several years he tried giving various hormones and other substances to patients with advanced cancer in the hope of achieving this result, but he did not succeed in finding any substance or mixture of substances that was effective.

I read his book and was much impressed by his argument. I had been working on vitamin C in relation to the common cold and other diseases, and in 1971 I had the idea that the known property of ascorbic acid of increasing the rate of synthesis of collagen would permit large doses of vitamin C to strengthen the intercellular cement by the increased synthesis of collagen fibrils, which are an important part of this intercellular cement. I mentioned this idea in an address that I gave at the dedication of the Ben May Laboratory for Cancer Research in Pritzker Medical School, University of Chicago. By then, Cameron had independently reached the tentative conclusion that ascorbate might be involved in the synthesis of the naturally occurring hyaluronidase inhibitor and had already begun cautiously to prescribe ascorbate to dying cancer patients under his care. In November 1971 he read an account of my address in the *New York Times*. We immediately corresponded, and this marked the beginning of a long and productive association.

Whereas Cameron had been disappointed in his trials of various hormones, he immediately thought that the treatment with vitamin C was of considerable benefit to the patients, and during the next ten years he gave the vitamin in large doses to several hundred patients with advanced cancer, almost all of them being patients for whom the conventional methods of treatment had been

tried and found to be of no further benefit. He and his coworkers published several papers on their observations. In one paper they reported that the vitamin C seemed to control pain quite effectively, so that patients who had been receiving large doses of morphine or diamorphine could stop taking the narcotic drug (Cameron and Baird, 1973). He also published a detailed report on the first fifty patients with advanced cancer to be treated with large doses of vitamin C (Cameron and Campbell, 1974), and a paper on one patient who seemed to recover completely from cancer when treated with vitamin C, in whom, however, the cancer returned when the intake of vitamin C was stopped, and who again recovered completely when the treatment with vitamin C was resumed. This patient continues to take vitamin C, 12.5 g per day, and after twelve years seems to be in excellent health (Cameron, Campbell, and Jack, 1975).

The first observation made by Cameron was that most of the ascorbate-treated patients entered upon a period of increased well-being and general clinical improvement. The benefits enjoyed by a majority of these patients included, in addition to increased well-being, relief from pain, a decrease in malignant ascites (cells shed from the tumors, potentially initiators of new tumors and so the agents of metastasis) and malignant pleural effusions, relief from hematuria, some reversal of malignant hepatomegaly and malignant jaundice, and decrease in the red-cell sedimentation rate and in the serum seromucoid level, all accepted indicators of lessening malignant activity. It was thus possible to conclude that both the increase in well-being and the apparent increase in survival time resulted from a significant attack by the ascorbate, either directly or by way of the natural protective mechanisms of the body, on the malignancy itself.

By 1973 it seemed to Cameron and me that a controlled trial should be carried out, in which half of the

patients, selected by tossing a coin or by some more sophisticated randomizing process, received 10 g of vitamin C each day and the others received a placebo. By that time, however, Cameron had become so convinced of the value of vitamin C to patients with advanced cancer that he was unwilling for ethical reasons to withhold it from any patient to whom he had the power to give it; accordingly he could not carry out such a trial with his patients. I then went to the National Cancer Institute to suggest that it carry out such a trial, as mentioned earlier in this chapter.

Even though we could not carry out a double-blind randomized clinical trial, we could carry out a controlled trial. The Vale of Leven Hospital is a large one, with 440 beds, and it registers about 500 new cancer patients each year. Although Cameron was the senior consultant surgeon in administrative charge of the 100 surgical beds, he was in direct medical charge of only some of these cancer patients. At first none of the other physicians or surgeons gave large doses of vitamin C to their patients, and even in later years many of the Vale of Leven cancer patients have not received this treatment. Thus there have been other cancer patients closely similar to the ascorbate-treated patients, receiving the same treatment, except for the ascorbate, from the same medical and surgical staff, in the same hospital. These patients could serve as the controls.

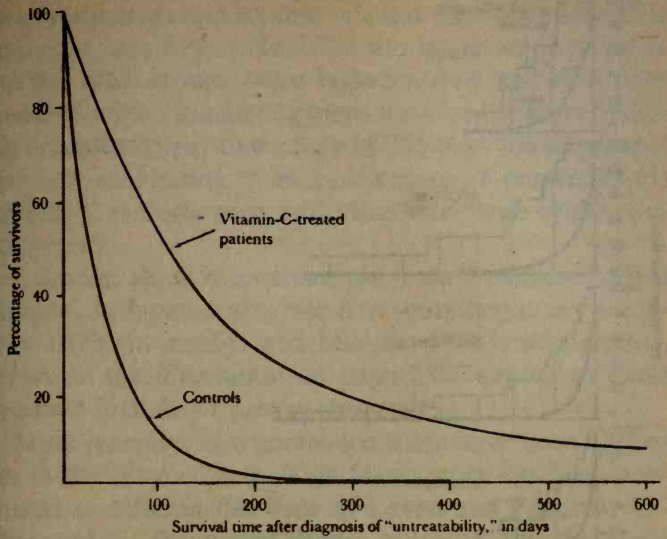
In 1976 we reported the survival times of one hundred terminal cancer patients given supplemental ascorbate and those of a control group of one thousand patients of similar initial status who had been treated by the same clinicians in the same hospital and who had been managed identically except for the supplemental ascorbate. The one thousand controls thus provided ten control patients for each ascorbate-treated patient, matched as to sex, age, primary tumor type, and clinical status of "untreatability." We employed an outside doctor, who had no

knowledge of the survival times of the ascorbate-treated patients, to examine the case histories of each of the control patients and to record for each of them the survival time—the time in days between the date of abandonment of all conventional forms of treatment and the date of death.

The results were surprising, even to us (see illustration on page 231) (Cameron and Pauling, 1978). By 10 August 1976 all of the one thousand control patients had died, whereas eighteen of the one hundred ascorbate-treated patients were still living. On that date the average time of survival after the date of "untreatability" was 4.2 times as great for the ascorbate-treated patients as for their matched controls. The one hundered ascorbate-treated patients have lived on the average more than three hundred days longer than their matched controls, and in addition it is our strong clinical impression that they have lived happier lives during this terminal period. Moreover, a few of them continue to survive, still taking their daily doses of sodium ascorbate, and some of them might well be considered to have been "cured" of their malignant disease, in that they are free of overt manifestations of cancer and are leading normal lives.

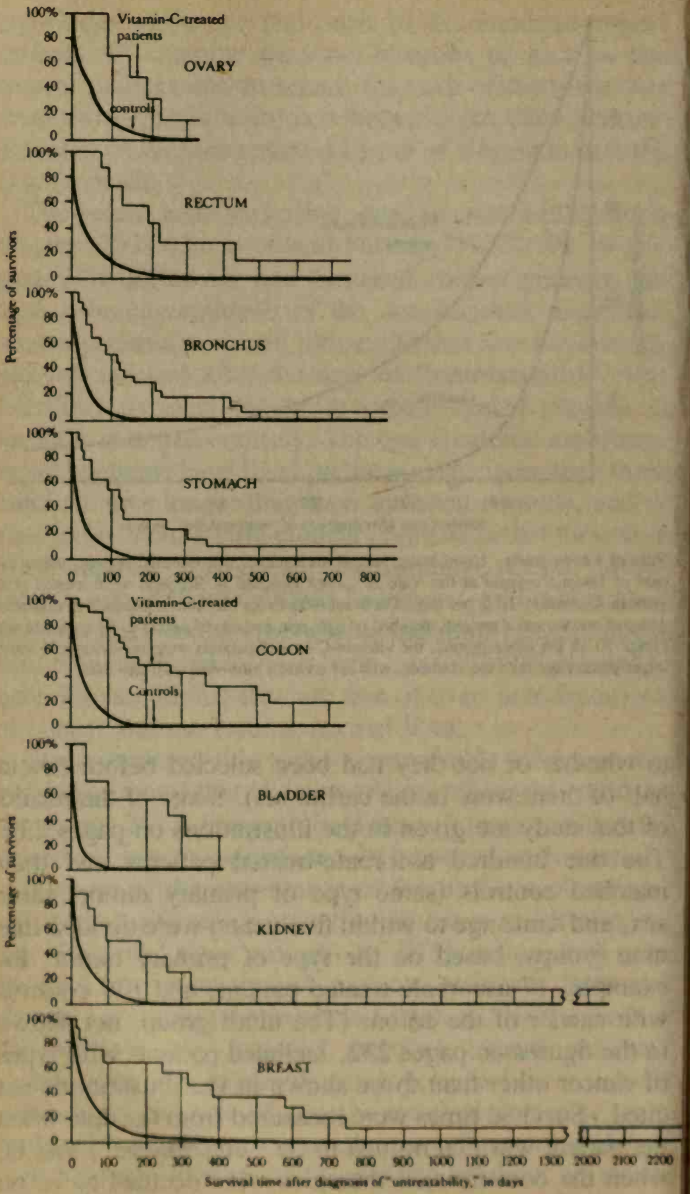
We considered this to be a remarkable achievement, bearing in mind that if the mortality of cancer could be decreased by 5 percent the lives of twenty thousand American cancer patients would be saved each year.

Because of the importance of the problem of cancer, we made a second examination of the case histories of the Vale of Leven patients in 1978, again with one hundred ascorbate-treated patients and one thousand matched controls (Cameron and Pauling, 1978). Ten of the original one hundred ascorbate-treated patients, mainly with rare forms of cancer for whom it had been difficult to find sets of exactly matched controls, were replaced by new ones, and the one thousand matched controls were independently selected, without regard as



Vale of Leven study Upon being judged untreatable, one hundred patients under the care of Ewan Cameron at the Vale of Leven Hospital in Scotland were treated with vitamin C, usually 10 g per day. Their survival times are here compared to a control group of one thousand patients matched by age, sex, and site of cancer to the experimental group. At all the times plotted, the vitamin-C-treated patients were surviving in a much larger percentage than the controls, with no controls surviving past day 500.

to whether or not they had been selected before (about half of them were in the earlier set). Some of the results of this study are given in the illustrations on pages 232 The one hundred ascorbate-treated patients and their matched controls (same type of primary tumor, same sex, and same age to within five years) were divided into nine groups, based on the type of primary tumor; for example, 17 ascorbate-treated patients and 170 controls with cancer of the colon. (The ninth group, not shown in the figures on pages 232, included patients with types of cancer other than those shown in the illustrations not cited.) Survival times were measured from the date when the patient was determined to be "untreatable"; that is, when the conventional therapies were deemed to be no


Vitamin-C-treated patients
OVARY
controls
RECTUM
BRONCHUS
STOMACH
Vitamin-C-treated patients
COLON
Controls
BLADDER
KIDNEY
BREAST
Percentage of survivors
100%
80
60
40
20
0
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 2000 2100 2200
Survival time after diagnosis of "untreatability," in days

longer effective—at this date or a few days later ascorbate treatment was begun. In 1978 the mean survival times for the nine groups were between 114 and 435 days greater for the vitamin-C groups than for the corresponding control groups, an average of 255 days for all groups, and were continuing to increase because 8 percent of the vitamin-C patients were still alive, and none of the controls were.

A similar study was carried out in the Fukuoka Torikai Hospital in Japan during the five years beginning 1 January 1973 (Morishige and Murata, 1979), with results, shown in the illustration on page 235, similar to those obtained in Vale of Leven Hospital.

More recently, two controlled trials have been carried out in the Mayo Clinic. This Mayo work has been publicized as refuting the Vale of Leven and Fukuoka Torikai studies. The record shows, however, that the Mayo Clinic doctors did not follow the protocols of those studies. That work has, therefore, only small relevance to the question of how great the value of vitamin C is for cancer patients.

The first Mayo Clinic study (Creagen et al., 1979), showed only a small protective effect of vitamin C. Cameron and I attributed this reported result to the fact that most of the Mayo Clinic patients had already received heavy doses of cytotoxic drugs, which damage the immune system and interfere with the action of vitamin C, and the fact that the controls were also taking vitamin C in much larger amounts than were the controls in Scotland or Japan. Only 4 percent of the Vale of Leven patients had received prior chemotherapy.

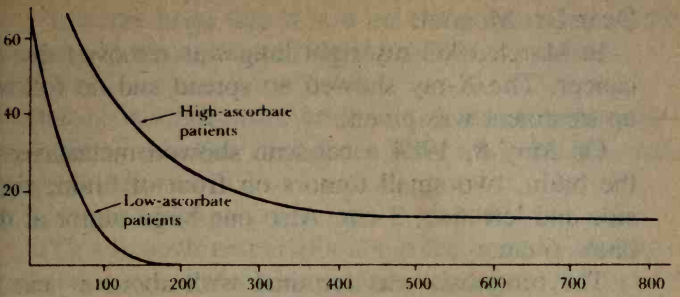
In our studies the vitamin-C patients took large

Vale of Leven survival times For cancers with eight different primary sites in the Vale of Leven study (summarized in the figure on page 231) the survival times of the vitamin-C-treated patients are compared to those of their matched controls. Survival is measured from the day the patient was judged untreatable. In conventional cancer statistics, survival for five years (1826 days) is recorded as "cure."

amounts of the vitamin, without stopping, for the rest of their lives or until the present time, some for as much as fourteen years. In the second Mayo Clinic Study (Moertel et al., 1985), the vitamin-C patients received the vitamin for only a short time (median 2.5 months). None of the vitamin-C patients died while taking the vitamin (amount somewhat less than 10 g per day). They were, however, studied for another two years, during which their survival record was no better than that of the controls, or even somewhat worse. The Moertel paper and a spokesman for the National Cancer Institute, who commented on it (Wittes, 1985) both suppressed the fact that the vitamin-C patients were not receiving vitamin C when they died and had not received any for a long time (median 10.5 months). They announced vigorously that this study showed finally and definitely that vitamin C has no value against advanced cancer and recommended that no more studies of vitamin C be made.

Their results provided no basis whatever for this conclusion, because in fact their patients died only after being deprived of the vitamin C. To the extent that their study showed anything, it is that cancer patients should not stop taking their large doses of vitamin C. Yet the study was heralded upon publication as one that reflected adversely on the Cameron-Pauling work.

When this Mayo Clinic paper appeared, 17 January 1985, Cameron and I were angry that Moertel and his Mayo Clinic associates, the spokesman for the National Cancer Institute, and also the editor of the *New England Journal of Medicine* had managed to prevent us from obtaining any information about their results until a few hours before their publication. Six weeks earlier Moertel refused to tell me anything about the work, except that their paper was going to be published. In a letter to me he promised that he would arrange for me to have a copy of the paper several days before publication, but he broke that promise.



Fukuoka Torikai Hospital study Matched experimental and control subjects received large amounts of vitamin C (5 grams or more per day, averaging 29 grams per day) and small amounts (4 g per day or less) respectively, upon being judged untreatable. Patients in the control group had all died by day 200, when 25 percent of the high-intake group were still alive. The six still alive on 10 August 1978, indicated by the long extension past 400 days, had survived an average of 866 days after being judged untreatable. (Adapted from Morishige and Murata, 1979.)

The misrepresentation by Moertel and his associates and by the National Cancer Institute spokesman has done great harm. Cancer patients have informed us that they are stopping their vitamin C because of the "negative results" reported by the Mayo Clinic.

It is not often that unethical behavior of scientists is reported. Fraud committed by young physicians doing medical research has been turned up several times in the last few years. Improper representation of the results of clinical studies, as in the second Mayo Clinic report, is especially to be condemned because of its effect in increasing the amount of human suffering.

The Mayo Clinic paper stimulated a vigorous response from the public addressed to Cameron and me. The first two letters reached me five days after the publication of the paper. The following excerpts are quoted with permission of the writers.

One letter was written to Moertel, the principal Mayo Clinic investigator, by a man in Utah, who sent a copy to me. It was written the day after publication, and the entire letter reads as follows:

Dear Dr. Moertel:

In March 1983 my right lung was removed due to cancer. The X-ray showed no spread and no follow-up treatment was given.

On May 8, 1984 a cat-scan showed metastasis to the brain, two small tumors on front of brain, right side and left side, 3 cm. Also one large tumor at the back, 6 cm.

The prognosis was terminal with about a year to live. The treatment was radiation at LDS Hospital, Salt Lake City which would shrink and control the tumors for a while, but not eradicate them.

I immediately went on a nutritional program which included Vitamin C. I went to my bowel tolerance level of 36 grams a day.

On July 9th another cat-scan was done at LDS Hospital and the tumors were completely gone. I just finished a follow-up cat-scan and chest X-ray which showed no sign of cancer.

I feel strongly that the Vitamin C (and other nutrients) together with the radiation removed the tumors. I am still on 36 grams daily and plan to be indefinitely and feel the Vitamin C has played an important part of my miraculous cure.

In the book "Cancer and Vitamin C" by Ewan Cameron and Linus Pauling, they *do not* suggest the use of vitamin C alone to cure cancer but only to augment traditional treatments.

My records are open for verification. I realize you do not like case histories, but X-rays and doctors reports plus real results are pretty good proof.

I do not know how much Vitamin C you gave in your blind studies, but each person's requirements are different. Therefore, any amount short of bowel tolerance levels, which could not be done in a blind study such as yours, is useless.

It is my hope that if you are truly interested in the cancer patient you will reconsider your position.

The second letter was written to me by an eighty-one-year-old man in San Francisco. Here are some excerpts from his letter:

This letter is essentially about the use of your basic theories concerning cancer and vitamin C. As I wrote before, I had surgery for colorectal cancer on 4 September, 1980. It had metastasized to the liver where a tumor about 35 mm in diameter was found. It was not operable under the circumstances. I started reading on the subject and taking injections of 5-FU at the same time. I knew you had written on vitamin C and the common cold but was unaware of your work with Dr. Cameron on cancer in Scotland.

In the literature, I quickly found that metastasized cancer to the liver was tantamount to a death sentence, survival rates ranging from a few weeks to 18 months. In most studies, untreated metastases had a survival period averaging 6.1 months. I also quickly became convinced that the fluorinated pyrimidine 5-FU was nothing more than a placebo. I decided to quit taking it. The oncologist I was seeing did not object and ordered a liver scan. This showed that the tumor had grown from 35 mm to 52 millimeters in diameter while I was taking the injections.

By nature, I am a sanguine man and since fifteen, I have known that life would be the death of me yet. Gathering all my material together and using your thinking on the subject as a guide, I worked out a regime based on vitamin C, vitamin E and other dietary supplements.

The second liver scan, after I ingested 10–12 grams of vitamin C daily for three months, showed no change

in the size or texture of the liver lesion. It was there, all right, but it had not grown. I continued my self-treatment, looked for a medical doctor who could help me. I found myself faced with an ocean of ignorance on the part of the medical fraternity as to the immensely complex process by which the human body absorbs and uses the materials upon which it exists. And profound indifference as to what I was doing. I know 12 doctors personally, most of them I consider friends. Five of them tell me that they had one course in nutrition for a single semester in medical school. The other seven had no course at all. None asked me anything about what I was doing.

I continued the liver scans, one each three months. The lesion remained the same until the ultrasound scan of 15 October, 1984. To my surprise, this scan showed a decrease amounting to 32% in the cubic content of the tumor. Because of the nature of the finding, the series was run twice. Once by the technician and then by the doctor in charge of the laboratory to make sure of an accurate finding. The tumor had also begun to be infiltrated with calcium.

During all of this time, I have been reasonably healthy with no sign of cancer, working at one thing or another and sailing our boat on the Bay. I have a chest x-ray each year because the normal path of the decrease is from the liver to the lungs. My lungs are clear.

In your writing, you suggest that the intake of ascorbic acid be moved up until one becomes uncomfortable and then to back down a bit. In your letter to me, you proposed 25 grams of C daily. I have been taking 36 grams daily for more than two years now. In divided portions, I have no difficulty with this.

I have planned on writing you for more than a year, but pure sloth has caused me to put it off. The present spur to my intent is the article read at breakfast two

days ago about the Mayo Clinic procedure. I think that this is a shabby business indeed. Mayo is the last place I would want to see used for a study of vitamin C under any conditions. They are flawed because of the manner in which they did their first so-called study. What is needed should be obvious to a blind man. That is, nothing short of a series of massive tests, using thousands of patients with scores of different kinds of cancer. And these grouped in various stages of this degenerative disease. It would have to be a national effort as no clinic, hospital or teaching university could possibly carry it out on the necessary scale.

I am sure that you are absoutely right in saying that vitamin C, while not a cure for cancer, is a vital and potent adjunct in the management and control of the disease. And it is a fact that any form of chemotherapy will damage the body's own immune system. In my case, I must have achieved a dandy immune system or my cancer would long ago have reached one of the lymph glands.

That the tumor on my liver has become non-invasive is obvious. That it will stay that way is not obvious. Knowing that it is there puts me in the position of living under the sword of Damocles. I am reasonably certain that I shall die of cancer... if I do not die of old age first. I was 81 years of age on January 16, 1985.

These letters are representative of scores of letters that Cameron and I have received. Such evidence may be dismissed as anecdotal when compared to the statistical evidence from large-scale trials—with inadequate intakes of vitamin C. The anecdotes nonetheless should challenge conscientious investigators to run large-scale trials with intakes of vitamin C as prescribed by Cameron.

In Chapter 26 I have more to say about the behavior

of Moertel and his colleagues in illustration of the difference between vitamins and drugs.

Based upon the results of our studies, Cameron and I have recommended that a high intake of vitamin C be taken by every cancer patient, as an adjunct to appropriate conventional therapy and beginning as early in the course of the disease as possible.

How many people could be helped in this way? The quantitative information that we have is based mainly on the observation of patients with advanced cancer in Scotland who received 10 g of vitamin C per day. As the result of observations on several hundred patients, Cameron reached the following conclusions about the effects of administering this amount of vitamin C to patients with advanced cancer:

- Category I. No response of tumors, but usually improvement in well-being — about 20%
- Category II. Rather small response — about 25%
- Category III. Retardation of growth of tumors — about 25%
- Category IV. No change in tumor (standstill) — about 20%
- Category V. Tumor regression — about 9%
- Category VI. Complete regression — about 1%

Better results are obtained with intakes greater than 10 g per day.

In our book *Cancer and Vitamin C*, Cameron and I stated our conclusion that "This simple and safe treatment, the ingestion of large amounts of vitamin C, is of definite value in the treatment of patients with advanced

cancer. Although the evidence is as yet not so strong, we believe that vitamin C has even greater value for the treatment of cancer patients with the disease in earlier stages and also for the prevention of cancer."

The last sentences in that book are the following:

> With the possible exception of during intense chemotherapy, we strongly advocate the use of supplemental ascorbate in the management of all cancer patients from as early in the illness as possible. We believe that this simple measure would improve the overall results of cancer treatment quite dramatically, not only by making the patients more resistant to their illness but also by protecting them against some of the serious and occasionally fatal complications of the cancer treatment itself. We are quite convinced that in the not too distant future supplemental ascorbate will have an established place in all cancer-treatment regimes.

We have now had the opportunity to observe patients who have taken 10 g or more per day of vitamin C during intense chemotherapy. It seems clear that there is benefit from the vitamin C, which controls to a considerable extent the disagreeable side effects of the cytotoxic chemotherapeutic agents, such as nausea and loss of hair, and that benefit seems to add its value to that of the chemotherapeutic agent. We now recommend a high intake of vitamin C, in some cases up to the bowel-tolerance limit (Chapter 14), beginning as early as possible.

There are many advantages to using vitamin C as an adjunct to appropriate conventional therapy in the treatment of cancer patients. Vitamin C is inexpensive. It has no serious side effects, but instead improves the appetite, controls the feeling of misery that plagues cancer patients, improves the general health, and gives the patient

a greater capacity to enjoy life. For every patient there is the chance that through its use, together with the appropriate conventional therapy and good intakes of other nutrients, the disease can be kept under control for many years.